**Claims**

We claim:

1. A latching switch device, comprising:

a passage, the passage being elongate and having a length;

a first cavity and a second cavity;

a channel extending from each cavity to the passage, the channels being spatially separated from one another along the length of the passage;

non-conductive fluid located the cavities;

a conductive liquid located in the passage, the conductive liquid including free surfaces;

a first electrode and a second electrode in electrical contact with the conductive liquid and located on opposite sides of one of the channels; and

a latching structure associated with each channel, each latching structure including energy barriers located in the passage on opposite sides of the channel, the energy barriers interacting with the free surfaces of the conductive liquid to hold the free surfaces apart from one another.

2. The latching switch device of claim 1, in which each of the energy barriers includes a first portion of the passage juxtaposed with a second portion of the passage.

3. The latching switch device of claim 2, in which the portions of the passage differ in wettability with respect to the conductive liquid.

4. The latching switch device of claim 3, in which:

one of the first portion of the passage and the second portion of the passage is closer to the channel than the other; and

the one of the first portion of the passage and the second portion of the passage that is closer to the channel has a lower wettability with respect to the conductive liquid than the other.

5. The latching switch device of claim 2, in which the portions of the passage differ in cross-sectional dimensions.

6. The latching switch device of claim 1, in which:

the channels each have a length; and

the channels have smaller cross-sectional dimensions than the passage over at least part of their length.

7. A latching switch device, comprising:

a passage, the passage being elongate and having a length;

a first cavity and a second cavity;

a channel extending from each cavity to the passage, the channels being spatially separated from one another along the length of the passage;

non-conductive fluid located the cavities;

a conductive liquid located in the passage; and

a first electrode and a second electrode in electrical contact with the conductive liquid and located on opposite sides of one of the channels; in which:

the passage includes a latching structure associated with each channel, each latching structure comprising a low surface energy portion of the passage and a high surface energy portion of the passage arranged in tandem along part of the length of the passage with the high surface energy portion closer to the channel, a free surface of the conductive liquid having a lower surface energy in the low surface energy portion than in the high surface energy portion.

8. The latching switch device of claim 7, in which:

the passage includes a wall; and

the wall is of materials that differ between the high surface energy portion and low surface energy portions.

9. The latching switch device of claim 8, in which the material of the wall in the low surface energy portions has a higher wettability with respect to the conductive liquid than the material of the wall in the high surface energy portion.

10. The latching switch device of claim 8, in which:

the wall is of a material that extends substantially the length of the passage, the material of the wall having a first wettability with respect to the conductive liquid; and

the wall supports a layer of a high-wettability material located in the low surface energy portion, the high-wettability material having a higher wettability than the first wettability with respect to the conductive liquid.

11. The latching switch device of claim 8, in which:

the wall is of a material that extends substantially the length of the passage, the material of the wall having a first wettability with respect to the conductive liquid; and

the wall supports a layer of a low-wettability material located in the high surface energy portion, the low-wettability material having a lower wettability than the first wettability with respect to the conductive liquid.

12. The latching switch device of claim 8, in which the low surface energy portion comprises a layer of metal supported by the wall.

13. The latching switch device of claim 12, in which the layer of metal is integral with one of the electrodes.

14. The latching switch device of claim 12, in which the layer of metal substantially surrounds the passage.

15. The latching switch device of claim 8, in which:

the passage has first cross-sectional dimensions in the high surface energy portion; and

the passage has second cross-sectional dimensions, greater than the first cross-sectional dimensions, in the low surface energy portion.

16. The latching switch device of claim 8, in which, in the low surface energy portion, the second cross-sectional dimensions progressively increase with increasing distance from the high surface energy portion.

17. The latching switch device of claim 8, in which:

the passage has cross-sectional dimensions; and

the cross-sectional dimensions of the passage increase abruptly between the high surface energy portion and the low surface energy portion.

18. The latching switch device of claim 7, additionally comprising a third electrode in contact with the conductive liquid and located on the opposite side of the other of the channels.

19. The latching switch device of claim 7, in which:

the low surface energy portion is a first low surface energy portion;

the latching structure additionally includes a second low energy portion arranged in tandem with the first low surface energy portion and the high surface energy portion; and

the first low surface energy portion and the second low surface energy portion are on opposite sides of the high surface energy portion.

20. The latching switch device of claim 7, in which:

the channels each have a length; and

the channels have smaller cross-sectional dimensions than the passage over at least part of their length.